v. 13 #4

The MONTHLY REVIEW

Published Monthly by the

American Electroplaters Society

A SOCIETY FOR THE ADVANCEMENT

OF THE

SCIENCE OF ELECTROPLATING

APRIL, 1926

Entered as second-class matter, September 26, 1922, at the Post Office at Oneida, N. Y., under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage, provided for in section 1103, Act of October 3, 1917, authorized September 26, 1922.

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MEMBERSHIP DRIVE

Fellow Members:

Allow me to urge you to complete the membership drive.

Most of the branches have shown the results that were expected of them and the members themselves know whether their branch is one of the progressive branchs or not.

Won't you please get those non-members in your district who are eligible to join at once?

E. J. MUSICK,
Supreme President.

MONTHLY REVIEW

Published by the

American Electroplaters' Society

ONEIDA, NEW YORK

Editor's Office, 166 Willow Place, Sherrill, New York

VOL. XIII APRIL, 1926 No. 4

EDITORIAL

THE AIMS, OBJECTS AND PURPOSE OF THE A. E. S. FROM AN EDITOR'S POINT OF VIEW

This is a big topic for a short paper or talk.

I assume we are gathered here this afternoon because we are in full accord with the aims and objects of this society.

The stated object of the Society is at least twofold: First, the improvement of the art of electro-deposition of metals; second, the **dissemination** of the knowledge of its practice.

Improvement in the art of electroplating is the responsibility of every member, who by study and experimentation learns to improve the art in his special field of endeavor, but to stop there and keep his knowledge under his hat does not carry out the object of the society. No, the knowledge thus acquired must be disseminated throughout the entire Society, and here is where the need of a publication, "THE MONTHLY REVIEW," and an editor is in evidence, and it is here we find the greatest need for co-operation.

The editor cannot be of much service unless the membership furnish him with the results of their studies and experiments, nor are your studies and experiments worth much to the Society unless they are disseminated. From the editor's point of view the dissemination of knowledge is a mighty important part of the objects of the American Electroplaters' Society.

This is why we appreciate the work of every member,

and ask for a continuation of your hearty co-operation that the aims and objects of the society may be more effectively realized, and in doing this you have a chance at winning the Proctor Gold Medal. I hope one of you men get it this year.

Now, as to the progress of the Society. The hearty response to the suggestion of our Supreme President to enlarge our membership will surely result in progress. It has already resulted in many new members. These new members should increase the number of experiments to impart their knowledge to all the rest of us.

To be a success is the ambition of every normal person or society, and we are all apt to envy the man or society who have demonstrated to the world that they are a success, entitled to wear the purple robe of success.

There are successful men and societies in every field of human endeavor and these successful men or societies are very different in appearance, size and nature of work accomplished, and in many other ways, but in one thing they are all alike. There is a scarlet line that runs through their purple robe of success, and it is that scarlet line that keeps the purple robe together, gives it its beauty and power. That scarlet line is work, work, work.

We have not yet achieved the goal that we have set out to reach. Progress has been made, but the goal—to substitute knowledge for guess-work and uncertainties—is still in the future; how far in the future depends on how hard we work and how we co-operate with each other and our officers and leaders.

The Society has started a campaign to raise the sum of $10,000 annually for research work by securing 200 manufacturers to subscribe $50 annually for at least three years. You have been asked, and will be again, to do personal work to interest your firm in this worthy undertaking. What is going to be your contribution in work in this step toward progress, in achieving the object of your Society, put the scarlet line of work into the Society's purple robe of success?

The Editor is anxious to get into the pages of the MONTHLY REVIEW the results of their $60,000 worth of research work that the $30,000 will do at the Bureau of

Standards under the direction and supervision of one of our hardest workers, Dr. William Blum, to whom the Society owes much, and who, we believe, will continue to be a big factor in making it possible for the A. E. S. to reach its goal—Knowledge in the Art of Electroplating.

A NEW METHOD FOR MEASURING POLARIZATION IN ELECTROPLATING[1]

By H. E. Haring[2]

[1]Published by permission of the Director of the Bureau of Standards, Department of Commerce

[2]Assoc. Chemist, Bureau of Standards.

I—INTRODUCTION

In papers published in recent years from the Bureau of Standards, it has been shown that the throwing power of plating solutions and the structure of the deposits are both greatly influenced by what is known as "cathode polarization." This term "polarization" has always had a rather vague meaning, even in scientific literature, and methods for its measurement have been complicated. The purpose of this paper is to describe a simple method and apparatus by which the polarization and also the resistivity (or conductivity) of plating solutions can be measured. Further details of the experiments by which the accuracy of this method was determined are contained in an article presented to the American Electrochemical Society in Chicago, April, 1926, and published in Vol. 49 of their Transactions.

II—GENERAL PRINCIPLES

Whenever an object is plated, the film of solution next to the anode becomes more concentrated in metal and the cathode film less concentrated in metal than the body of the solution. This is, of course, due to the fact that those factors which tend to maintain a uniform solution cannot keep pace with the speed of dissolving at the anode and depositing at the cathode. Now, it is more difficult to dissolve metal in the concentrated anode film and also more difficult to deposit metal from the dilute cathode film than it would be if the solution were entirely uniform in composition throughout the bath. Because of this increase in the dif-

ficulty of solution and deposition, a higher tank voltage is required to maintain a certain current density. This increase in voltage required is known as "polarization." That part of polarization which is due to the anode reaction is known as "anode polarization," and that part due to the cathode process is known as "cathode polarization."

As is well known, it also requires a certain voltage to overcome the resistance of the solution. This voltage may be calculated from Ohm's law, according to which the cur-

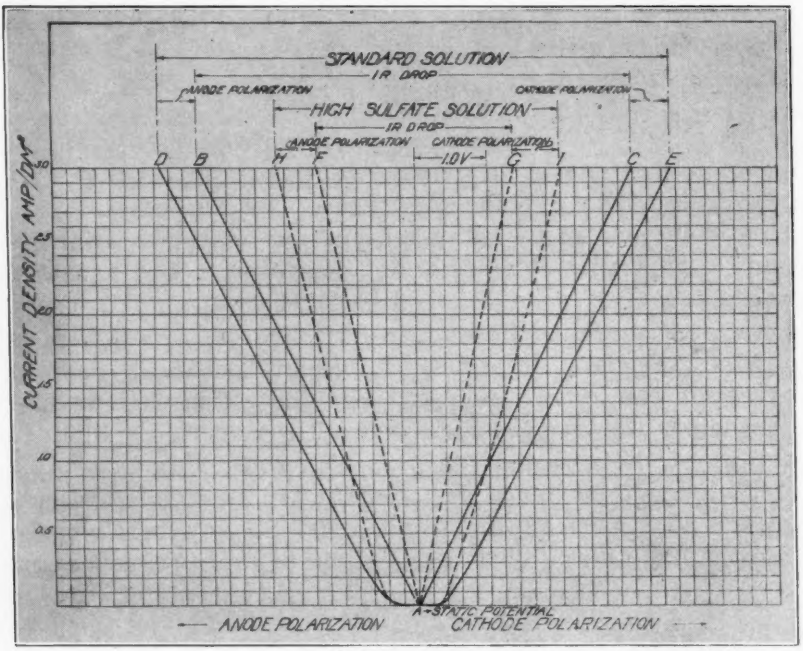

FIG. 1

Diagram showing total voltage drop during the electrodeposition of nickel.

Solid lines for solution containing nickel sulfate—N (19 oz/gal), ammonium chloride—0.25 N (1.7 oz/gal), boric acid—0.25 M (2.0 oz/gal).

Dotted lines for solution with the same constituents as above plus sodium sulfate—3 N (28 oz/gal. anhydrous).

(In this and other figures, the current density in amp/dm² is equal to about one-tenth of that in amp/sq. ft.)

rent is equal to the voltage divided by the resistance, i. e.,

$$I \text{ (current)} = \frac{E \text{ (voltage)}}{R \text{ (resistance)}}$$

Expressed in another way, the voltage is equal to the current times the resistance, i. e., E=IR. The voltage required to overcome the resistance of the bath is often referred to as the "IR drop."

We see then that when an electrolysis is conducted between a soluble anode and a cathode, both consisting of the metal to be deposited, the total voltage required is equal to the sum of three parts, viz.: the anode polarization, the IR drop and the cathode polarization. This relation is illustrated in Fig. 1 for a standard nickel solution (solid lines) and for one containing a large amount of sodium sulfate (dotted lines) such as has been suggested for nickel plating on zinc and for barrel plating. In this diagram the space between the lines AB and AC represents

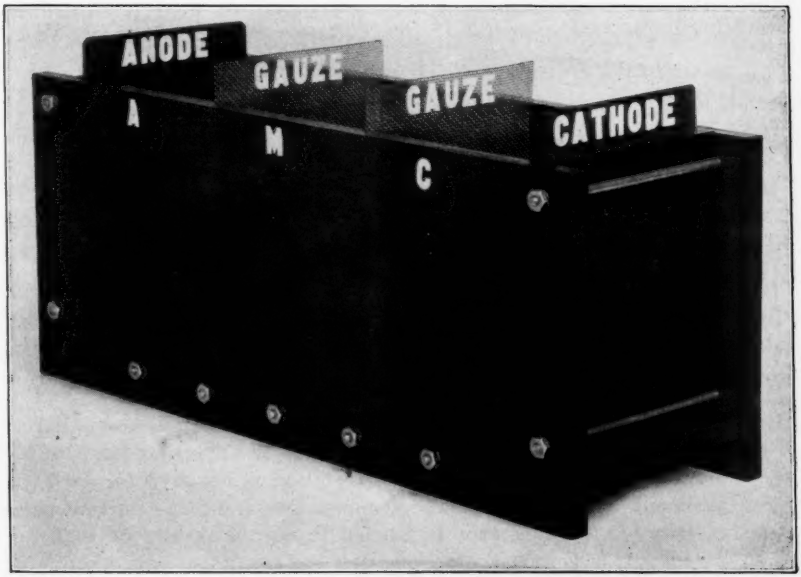

FIG. 2

Cell used for polarization and resistivity measurement

the IR drop for the standard solution; that between AB and AD is the anode polarization, and between AC and AE is the cathode polarization. The dotted lines show the corresponding data for the high-sulfate solution.

From this diagram the total voltage required to produce any given current density between plane electrodes 10 cm (4″) apart, may be computed. It will be noted that although the anode and cathode polarization are both higher in the high-sulfate bath, the total voltage required is always greater for the standard solution, because its resistivity is higher than that of the high-sulfate bath.

III—MEASUREMENT OF POLARIZATION

The apparatus (Fig. 2) devised for measuring polarization consists of a rectangular hard rubber tank, the inside of which may be for example 10 cm (4″) wide, 30 cm (12″) long, and 10 cm (4″) deep (up to the top of the solution).

In experiments with copper solutions, a sheet of copper is placed in slots at each end, and two copper gauzes[2] in slots 10 cm (4″) from each end. The tank is filled with the copper solution to a depth of 10 cm (4″). In this way the box is divided into three equal parts, marked A (anode), M (middle) and C (cathode).

In experiments with nickel, nickel gauze which has been nickel plated can be used, together with a sheet of nickel for the anode, and of brass for the cathode. For silver plating, iron or nickel gauze, heavily silver plated, may be employed and the anode and cathode may be silver plated sheet steel. For solutions with high resistivities, such as those of nickel and silver, it is desirable to space

[1]Recently a smaller box has been constructed, in which the solution is contained in a space 5x5x15 cm (2″x2″x6″). This box has the advantage that a smaller volume of solution is required for each experiment. Owing to the smaller dimensions and lower current used in this box greater care is needed to obtain results of high accuracy. It is believed, however, that the results will be essentially the same as those described in this paper, which were obtained in the large box.

[2]Twenty mesh gauze was used in these experiments.

the anode and cathode only 15 cm (6″) apart and to place the two gauzes 5 cm (2″) apart.

If instead of copper gauze, the intermediate electrodes consisted of solid copper plates, copper would deposit on the side nearest to the anode, and would dissolve from the other side, just as in "series" copper refining. In other words, one side of the plate would be cathode and the other side anode, and on each side there would be a corresponding change in the composition of the adjacent solution, and therefore polarization. If, however, gauze is used, the solution from the two sides mixes automatically, so that there is no appreciable change in composition and hence no polarization.

If in the middle compartment (M) there is no polarization, the total voltage drop between the two gauzes must be due solely to the resistance of the bath between them. If this voltage and the current are measured, it is easy to compute the resistivity of the solution. If the solution in the middle compartment occupies a cubic 10 cm (4″) on a side, the resistivity of the solution in ohm-centimeters is equal to ten times the voltage divided by the current. Thus, if for a current of 0.50 ampere, the potential between the gauzes is 0.75 volts, the resistivity of the solution is

$$10 \times \frac{0.75}{0.50} = 15 \text{ ohm-centimeters}$$

(For a box of different dimensions this calculation would be changed correspondingly.)

As the anode compartment (A) and the cathode compartment (C) are just the same size as the middle (M), there must be in each of them the same voltage drop due to resistance. But if the voltage across each of the three compartments is measured, it will be found to be higher in A and C than in M. Thus these three potentials may in a given experiment be

A 0.95 V
M 0.75 V
C 1.05 V

The higher voltage in A and C is evidently due to the polarization occurring at the anode and cathode. To measure these polarizations, all that is necessary is to subtract the

voltage in M from that in A and C respectively. In this case

Anode polarization=A—M=0.95—0.75=0.20 V

Cathode polarization=C—M=1.05—0.75=0.30 V

To measure these potentials across the three compartments it is necessary to use a fairly sensitive voltmeter with a high resistance. For most purposes a voltmeter with a range of 5 V, a resistance of at least 500 ohms, and a scale that can be read to 0.01 V, will be satisfactory. In making measurements on some types of solutions, for example, a nickel plating solution, the needle of the voltmeter will be seen to reach a maximum value and then to slowly recede. The maximum reading of the voltmeter is the correct one.

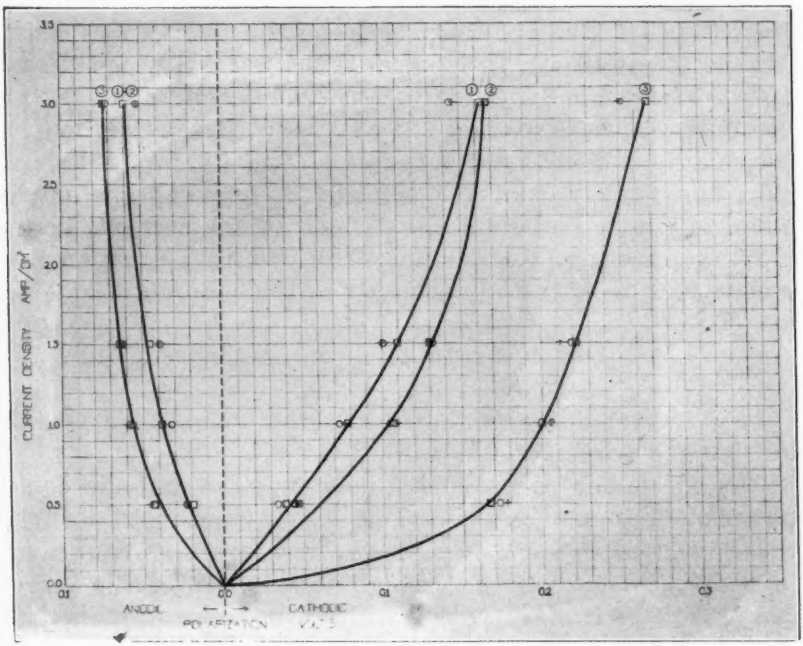

FIG. 3

Polarization curves in copper deposition.

Curve:

(1.) Copper sulfate—1.5N (25 oz/gal), sulfuric acid—1.5N (9.9 oz./gal).

(2). Same as (1) plus 0.0003 oz/gal glue.

(3). Same as (1) plus 0.003 oz/gal glue.

In order to study the behavior of a solution it is desirable to make polarization curves, that is, to measure the polarization at each of several current densities. For measuring the current it is usually satisfactory to have an ammeter with a scale up to 3 amperes that can be read to 0.01 ampere. The solution in the box should be thoroughly mixed each time the current density is changed. To reduce the heating and possible changes in composition, the current should be run through the box only long enough to give a constant potential for the current density used.

IV—APPLICATION OF POLARIZATION

The application and value of such measurements is shown by the curves in Figs. 3, 4 and 5, based on measurements made by this method upon copper, nickel and silver plating solutions. Tests showed that the results are reliable for each of these solutions, which represent the three principle types used in plating, i. e., acid, nearly neutral, and alkaline.

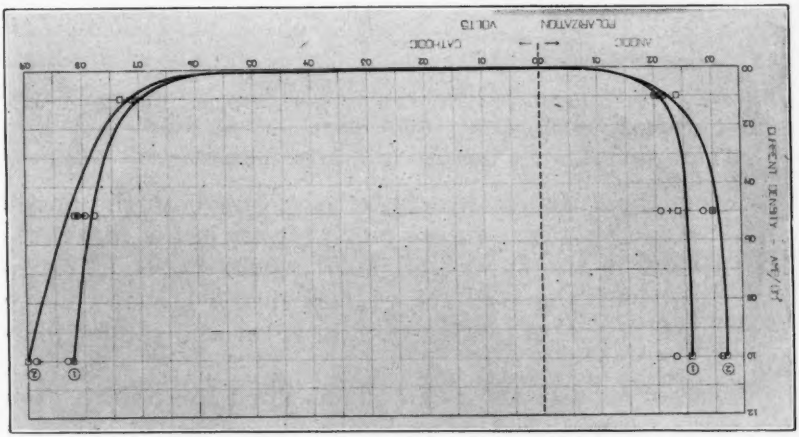

FIG. 4

Polarization curves in nickel deposition

Curve:

(1) Nickel sulfate—N (19 oz/gal.) ammonium chloride—0.25N (1.7 oz/gal), boric acid—0.25 M. (2.0 oz/gal).

(2) Same as (1) plus sodium sulfate—2 N (19 oz/gal).

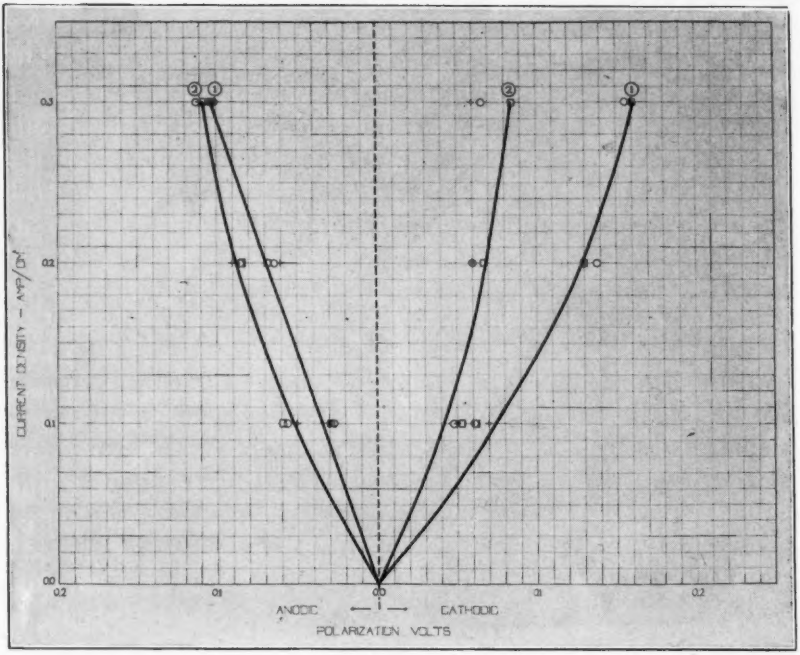

FIG. 5

Polarization curves in silver deposition

(1) Silver chloride—0.25 N. (4.8 oz/gal), sodium cyanide—1.00 N (6.6 oz/gal).

(2) Same as (1) plus 0.001 oz/gal carbon disulfide.

From these figures it may be seen that both the anode and cathode polarization are much higher in the nickel solution than in the silver and acid copper baths. This is consistent with the well-known fact that a higher voltage is required in nickel plating than in silver and copper plating.

The curves also show the effects upon the polarization produced by additions to the solutions. Thus in Fig. 3 it may be seen that very small amounts of glue in an acid copper solution produce a decided increase in the polarization. This explains the prevalent use of glue in copper refining solutions to produce smoother deposits, as in general an increase in cathode polarization produces finer crystals. The change in polarization produced by the glue furnishes a simple means of determining the effective amount of glue

in such a solution. Several copper and lead refineries are now using this apparatus to measure the polarization and thus control the glue content of their solutions.

From Fig. 4 it is evident that the addition of sodium sulfate to a nickel solution increases the polarization at both the anode and cathode. Its effect on cathode polarization is the chief reason for using sodium sulfate in the bath for nickel plating on zinc. The high polarization, together with the lower resistivity (higher conductivity) of the high sulfate bath (as shown in Fig. 1) increase its throwing power and make it especially good for barrel plating.

In Fig. 5 it may be seen that carbon disulfide, used as a brightener in silver plating, actually decreases the polarization. This result was surprising, as in most cases a brighter deposit is produced when the cathode polarization is increased. More detailed study will be required to clear up this apparent exception. It was noted that with carbon disulfide in the solution, it is possible to use a much higher current density before "burning" than without it. Probably therefore a large part of the brightening effect of carbon disulfide is due to the customary use of higher current densities when it is present. If further tests show that carbon disulfide always decreases the polarization it may still be possible to use these measurements to determine the content of carbone disulfide in the silver solution.

V—CONCLUSION

It is believed that by measurements of polarization and resistivity, such as can readily be made in this apparatus by a plater with moderate laboratory experience and equipment, or by a chemist working in co-operation with a plater, much valuable knowledge can be obtained regarding the operation and possible improvement of plating solutions. From such measurements it may often be possible to predict the most favorable operating conditions, and to control the composition, especially when very small amounts of addition agents are present.

The author is indebted to W. P. Barrows for assistance, and to William Blum for helpful advice in connection with this investigation.

BRASS PLATING SOLUTIONS

By David Ayres, Prescott, Ont.

So many good papers have been written by platers and electro-chemists that I hardly expect to quote anything new; however, this short paper is directed to platers who have to keep their solutions in good working order, principally by observation. By this, I mean they probably have neither the time nor the apparatus for analyzing.

It is doubtful if there is any plating solution that has caused the plater more trouble and worry than the brass solution, and, of course, the reason for this is quite apparent to a large majority of our craft, namely, that in brass we have two metals to contend with, and new formulae have been tried from time to time in an effort to standardize the brass solution, but we can hardly say that we have accomplished our desire, but when we consider the increasing demand for brass-plated goods of every description and the different metals that have to be brass-plated, it would seem that this very fact has been and is, at the present time, the cause of so many different formulae being in use. Incidentally, I believe that the most simple mixture will give the least trouble.

At the present time we are operating two still tanks of 300 gallons each, four horizontal barrel tanks of 60 gallons each. We will discuss them separately, taking the still tank first:

1. As to solution I have found during the number of years that the sodium cyanide solution gives the best all-round results. The first brass solution I operated 30 years ago was somewhat similar to those I am working today, except that in those days it was potassium cyanide.

Now, when I took this plant over about four years ago, of course these solutions were already mixed and had been in operation for some years previous, but I was fortunate in being able to secure the original formula, which is as follows:

Water, 1 Gallon	Sodium Cyanide, 1 Lb.
Copper Cyanide, 8 Ozs.	Zinc Cyanide, 4 Ozs.
Soda Ash, 2½ Ozs.	Ammonia Chl, ¼ Oz.

Dissolve in either hot or cold water in the order named,

stir thoroughly until all ingredients are dissolved. This is the base solution, and, of course, can be varied by adding more or less water, according to density required. The proportion of copper and zinc can also be varied according to the convenience of the operator.

In operating any brass solution among the troubles met with, the most frequent is no doubt when the deposit is off color; in fact, is liable to take on any shade, but most generally red or bronzy tint. There may be said to be three distinct causes, namely, low current density, excess of copper in solution, but the most frequent we believe to be excess of zinc, which can be detected by the appearance of that bronzy tint on parts protruding towards the anodes or turning to a decided zinc color if current is slightly increased.

The remedy is cyanide of copper dissolved in the usual amount of cyanide of sodium and soda ash.

Blistering caused by excessive current, also lack of cyanide in bath which may easily be remedied, and here we think it a good practise when any solution needs a remedy it should be added just at the close of the day.

I keep solution in still tanks from 10 to 12 baume; every week-end we add from 3 to 5 gallons to each tank to replenish the loss caused from drag out and possibly evaporation, and here I come to a point which should be noted: **I use very little, if any, Zinc in this, what may be termed toning up solution;** in fact, I find occasionally if solution goes a little off color the addition of cyanide of copper brings it back very quickly (an excess of zinc in brass solution causes what is called zinc red). I have long discontinued the use of liquid ammonia, which, I think, may be considered in the nature of a medicine added to a sick solution, and like numerous remedies administered to us humans, it does more harm than good, and should only be used in case of emergency. The chloride of ammonia in the original solution is sufficient. In one of the tanks I use sheet brass anodes and in the other one cast anodes and get excellent results from both. None of the products from these baths are lacquered before they go on the market. They consist of curtain rods of all sizes, some solid and

some steel tubes, all plated in racks. Both these solutions get the same treatment, with this exception: I find that while the bath which carries the cast anodes requires very little if any addition of zinc, the one carying the sheet brass anodes requires a percentage of about 1 lb. to 5 lbs. or 6 lbs. of copper about every two weeks. This, no doubt, is due to the different class of anodes. Cast anodes corrode more readily than the rolled sheet brass. Both baths are eqquipped with volt and ammeters and 12 step rheostats, which give ample variation for the different loads which they have to carry from day to day. We keep a solution composed of 1 lb. caustic soda to ¼ lb. white arsenic boiled in 1 gal. of water, and keep this on hand to be used in small quantities as a brightener, both in still and barrel solutions, but this must be used carefully as any excess will cause the deposit to blister.

The remedy is cyanide of sodium dissolved in the bath and stirred. This seldom fails to correct the trouble. We find it a good plan to stir solutions occasionally, but never go to the bottom of tank, as this would bring the sludge up and generally causes trouble. A good plan is to get rid of this accumulation about every six months, or at least, every year.

In regard to the barrel tanks I use the same formula; that is, the same ingredients, but a greater density, and at this point comes another difference. While the still solutions require a very small addition of zinc, the solutions for barrel plating require zinc almost in the regular proportion whenever solution is being added, which is every week-end. This simply means that a large proportion of the deposit comes from the solution, which, I believe, is the case in all motion plating, but there may be a difference of opinion on this point, but we are open to conviction.

These baths are equipped with rheostats only, and, like Mr. Coles, whose paper I read in the December REVIEW, we leave them wide open. The voltmeter on the main line reads 6 volts; if it does not, we find out why.

I will not try to enumerate the number of articles of all sizes and shapes that go through these solutions in a day, but we divide them into groups, each group to one particular barrel, as far as this is possible, and we find this a very

good practice, for it would seem at times these brass plating barrels like to be humored, no matter how well they are kept.

About 75% of the product is burnished in steel shot enclosed in wood-lined burnishing barrels with about 5 or 6 ozs. of a good soap compound added with each batch. Each burnisher has a capacity to carry the amount of work that comes from a plating barrel. The time of burnishing varies from ½ to 1 hour. The contents of burnisher are emptied into a tray equipped with a ¼-inch mesh wire seive, washed with warm water and shaken until the shot is separated from product. The product is then dried in a revolving galvanized iron cylinder which is enclosed in a wood casing with steam coil underneath, forming a revolving hot sawdust box, a real good drier for this class of work.

The product from the plating room goes to the packing room to be assembled and as that which comes from the barrel tanks in a great many cases has to match that which comes from the still tanks, you will readily see that someone has to keep their eyes open. Now, in closing, there are probably a few points we have failed to touch. We have said nothing of cleaning work before plating, but this is such a lengthy subject that we will leave it to some later date. There is a probability that we have failed to bring out any new points, but it is the sincere hope of the writer that someone will find something of interest.

BRANCH NEWS

Chicago Branch

Regular monthly meeting of Chicago Branch, A. E. S., was held April 10, 1926, at the Atlantic Hotel. The meeting was called to order with President H. L. Greenwald presiding, and all officers present.

There was a very good attendance. After the regular routine of business President Greenwald called upon Mr. E. Lamoureux, Chairman of the Railroad and Publicity Committee, on the coming convention. Mr. Lamoureux stated that the committee had chosen the "Capitol Limited" of the B. & O. Railway as the official train for our members. Letters regarding the same will be forwarded to all members.

Mr. O. E. Servis, Chairman of the Research Committee, reported that he had secured two papers to date for the convention; also instructed the members who wish to send exhibits to forward the same to care of Mr. F. J. Hanlon, 216 N. Jefferson street, Chicago, Ill., from where they will be shipped to the convention; also requested members who have exhibits or who will have them, to have same ready in order to have ample time to make the shipment.

Following the reading of communications of Research Committee on the Bureau of Standards' Fund Drive, President Greenwald proceeded to appoint a committee of some of our best high-powered salesmen to act on this drive. This committee consists of Mr. F. J. Hanlon, Chairman; Mr. O. E. Servis, Mr. R. J. Hazucha, Mr. S. E. Huenerfauth and Mr. R. Sliter, with instructions to Mr. Hanlon to choose any timber of the Branch that he sees fit to assist him in this drive; also explained to members present that they should CO-OPERATE with this committee in every way possible, so as to get this fund over the top as soon as possible.

Mr. Fred Liscomb read some data which was requested for the joint meeting of the American Chemical Society and Electroplaters to be held at noon, April 22, 1926, at the Chicago Beach Hotel, where they are holding a convention. All Electroplaters are invited to attend.

Our next meeting will be election of officers and all members were urged to attend.

QUESTION BOX—CHICAGO BRANCH

Question—Will an excess of bi-sulphide of soda cause a copper solution to plate rough and muddy?

Answer—Yes, and addition of cyanide was suggested to overcome this condition.

Question—What is the economical way to color brass plate black?

Answer—Black nickel was recommended.

Question—What can be done to reduce hydrogen at the cathodes in a nickel solution that has a P.H. of 5.9?

Answer—Member who asked this question stated that he overcame this condition by adding metal.

Question—What causes streaks in acid copper plating and remedy for the same?

Answer—Lack of acid was the cause of this streaking.

Question—Will cadmium plated on steel form an electro-motive force when in contact with cast iron that will cause the same to rust as freely as zinc-plated iron?

Answer—This caused a lively discussion and consensus of opinion was that it would.

Question—Can an alloy of nickel and chromium be successfully electro-deposited?

Answer—No.

Boston Branch

Boston Branch met Friday, the 9th, with Past President Gale in the chair.

After the regular order of business was over we were given a talk by Mr. Lawrence of the J. B. Ford Company. It was very interesting and a vote of thanks was extended to Mr. Lawrence, and it is hoped that he will come to Boston some other time and give us another talk.

Discussion followed in which Mr. Lawrence answered all questions

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Indianapolis Branch

Indianapolis Branch held its regular meeting April 10 with a fair attendance. One member was reinstated. The meeting was made as short as possible, as Mr. Humphries of the Metals Protection Corporation escorted us to that plant and laboratory to give us a talk and demonstration on chromium plating. It was not only interesting to us, but surprising to see the hardness of that deposited metal and the different articles it can be used on to advantage. We feel proud of the progress Mr. Humphries and his assistant are making along this line, and predict a bright future for chromium plating.

This meeting or evening was one of the most profitable Indianapolis Branch has had for some time.

Milwaukee Branch

We regret to announce the death of Edward A. Wieman on April 6, 1926. Mr. Wieman had been ill for about 10 years. He was one of our charter members and was very active in our society up to the time of his illness. Milwaukee Branch voted $150 for the A. E. S. Research Fund. The following were nominated for office: President, R. M. Goodsell; vice-president, E. Werner; secretary-treasurer, J. N. Hock; librarians, F. Marx, Mr. Nishwitz; assistant librarian, Mr. Bilicki; board of managers, R. Steuernagel, Dan Wittig and A. Brown.

St. Louis Branch

Regular meeting of St. Louis Branch was held at Barr Branch Library, April 6, with President E. J. Musick in the chair, and fourteen members present. One new application received from Gustav C. Pahlow, Galesburg, Ill., for active membership. The letter from research committee was read and a motion carried that St. Louis Branch subscribed $50 per year for three years toward the A. E. S. fund. The president also appointed a committee to take care of papers and exhibit for the Newark Convention, with H. H. Williams and Hedley J. Richards on this committee—snuff said. After regular business was taken care of, Hon. Richards took over the meeting in the absence of our librarian and the rest of the evening was spent discussing every-day problems. Meeting adjourned at 10:15 P. M.

New York Branch

The March meetings of the New York Branch, A. E. S., were well attended and conducted. The features of these meetings were the lively discussions on high-tension copper (acid) solutions, by Mr. Philip Morningstar of the K. & O. Mfg. Company and Mr. Adolph Stremel of the Charles Schaefer Company, Platers; also Mr. Joseph Downs on modern silver-plating methods employed by the International Silver Company of Meriden, Conn.

Mr. F. F. Pierdon of Washington, D. C., wishes to form a branch either in Washington or Baltimore. It would be well if any in that locality who are interested or know of any members or platers not members there would write Mr. Pierdon.

Philadelphia Branch

Philadelphia Branch met at the Harrison Building, U. of P., for their regular monthly meeting April 2, and was presided over by the President, George Gehling.

After the regular routine of business we had the pleasure of hearing our good friend, George Hogaboom give us a very interesting talk on "Chlorides in Nickel Solutions," and also explained the use of volt and ampmeter. This talk of Mr. Hogaboom's was very much appreciated and he was given a rising vote of thanks.

Vocational School Committee made an encouraging report of the progress of the work up to the present.

The Branch voted to subscribe $50.00 for three years to help carry on the good work of the Research Committee, and appealed to the members to solicit subscriptions for this purpose from their employers.

At the May meeting Mr. Shadell will speak on metal coloring as practised in the automobile trade.

Hartford-Connecticut Valley Branch

Hartford-Connecticut Valley Branch met on Monday, March 22, at the Chamber of Commerce rooms, Springfield, Mass. The meeting was very well attended.

The question of our participation in the Newark Convention was discussed and it was decided that we get up a branch exhibit containing, if possible, samples of the work of every member; also Mr. Kennedy was delegated to write a paper, which will be presented at the convention.

In response to an appeal from the Research Committee for funds it was unanimously voted to donate fifty dollars a year for three years to the fund which is being raised.

The speaker at this meeting was Mr. George Lawrence, who spoke on "Cleavers." Mr. Lawrence brought out a number of useful points to observe in the selection and operation of a cleaning solution, and answered a number of questions.

Mr. Oberender represented the Bridgeport Branch and issued an invitation to all platers to attend their banquet on Saturday, April 24.

Toronto Branch

The appeal for ten subscriptions to Research Fund from this district was received with a truly creditable spirit by our members on March 22. We realize we have a stupendous task ahead, but we are going to make a united effort. The manufacturers will know more of the A. E. S. when we finish, even though we fail to get the money. Mr. John Acheson is chairman of the cocmmittee and John has the knack of making a success of nearly everything. The feature for this meeting was a talk on "Nature's Danger Signals in the Human Face," given by Mr. W. M. Bell-Smith, illustrated with lantern slides. The topic for discussion, Acid Copper Baths versus Cyanide Copper Baths, was given a very spirited consideration by fully 50 per cent of those present. Both solutions were adjudged indispensible for certain commercial purposes. Acid copper was favored for heavy deposits and economy in operation cost. Ten members promised to co-operate in preparation of a paper for the convention.

Topic for April meeting will be "Operation of Cyanide Zinc Solutions." Mr. J. R. Moore of Carleton Place is to engage in the boot and shoe business and handed in his resignation, to take effect May 31, 1926.

Newark Branch

The following is the report of our April 16 meeting: Our meeting on Friday evening, April 16, was presided over by our President, George Reuter. Minutes were approved as read. Messrs. Nelson F. Sievering and H. J. Graff were elected to active membrship. Convention Committee reported progress through its chairman, Horace H. Smith.

Considerable publicity has been given our chemistry class and the 1926 convention through the local newspapers in the form of an editorial; also a writeup with photo of class in the laboratory, and a motion was made and seconded; also carried, that the Secretary file these newspaper clippings for future reference.

Discussions on the brass solution, copper dipping on iron, and the

elimination of carbonates from cyanide solutions were very interesting and at 10:30 p. m. adjournment was called for.

Bridgeport Branch

On account of the first Friday of April being a holiday, the regular meeting of this branch was held on the second Friday of the month. President Flaherty presided over a fair attendance.

This branch was grieved to hear of the death of Mrs. Phillip Willett and the secretary was directed to write Mr. Willett a letter expressing our sorrow.

Mr. Jordan of the Philadelphia Branch was present and favored us with a few remarks. Mr. Wagstaff, who was recently elected to membership, also told us that he was pleased to become a member of our society.

The banquet committee reported progress.

A committee, consisting of R. J. O'Connor, George Belle and William Thompson, was appointed to assist locally the 1926 Convention Committee.

QUESTION BOX

Q. What is a good formula for black nickel barrel plating on steel?

A. First nickel plate the parts and transfer to barrel containing the following:

8 oz. double nickel salts
2 oz. sulpho-cyanide
1 oz. zinc sulphate
1 gal. water
1 volt

If a blacker finish is desired after plating immerse parts in a solution made up as follows:

12 oz. perchlorate of iron
1 oz. hydrochloric acid
1 gal. water

The above formula was submitted by William Thompson.

Q. What is a good solution to brass plate white metal die castings?

A. The consensus of opinion on this was that the important part of this process was in the preparation, if properly cleaned, etc. Any good brass formula would give results. One member stated that a concern that turns out a great many die castings of an expensive nature was first flashing in cyanide copper, then plating 1 hour in acid copper, bridge dipping and then brass plating, some of the work being gold plated afterwards. Mr. Downs stated that quite a few concerns that he knew of were putting the brass right on the die casting while others were nickel plating first. Both were getting good results.

ELECTED TO MEMBERSHIP

Philadelphia Branch

Stephen A. Farris .....227 Chapel St., Luzerne, Pa.
William R. Schofield, Associate..5843 N. Lawrence St., Philadelphia, Pa.

New York Branch

Axel Terho .....37 West 90th St., New York City
Anthony Knechtel .....1255 Jefferson Ave., Brooklyn, N. Y.
Charles F. Beck, Active .....c|o Yale Towne Mfg. Co., Stamford, Conn.

Newark Branch

Albert H. Schnering, Active.....749 So. 18th St., Newark, N. J.
Joseph A. Comforte, Active .....169 Thomas St., Newark, N. J.
Nelson F. Sievering, Active .....24 Stanford Place, Montclair, N. J.
Henry J. Graff, Active .....611 Magie Ave., El Moro, Elizabeth, N. J.

Toronto Branch

John Lockridge, Active .....Wingham, Ontario, Box 254

REINSTATED

Indianapolis Branch

F. E. Thompson .....1315 N. Wisconsin St., Racine, Wis.

APPLICATIONS RECEIVED

Chicago Branch

Paul H. Mueller, Active .....1003 Hawthorne Ave., Waterloo, Iowa
Louis C. Roesberger, Active
11831 Vose St., Route 2, Box 280, Lankershin, Calif.

Hartford-Connecticut Valley Branch

Walter J. Wilford .....c|o Corbin Cabinet Lock Co., New Britian, Conn.
Chas. D. Lane .....20 Walter St., Springfield, Mass.

BOSTON

Regular meetings are held first Friday of each month, at 8 p. m., at the Boston Platers' Supply Co., 202 Friend St., Boston. Secretary, A. W. Garrett, 89 Alexander St., Dorchester, Mass.

BRIDGEPORT

Meets first and third Friday of each month at 62 Cannon St., Room 17, Bridgeport, Conn. Secretary R. J. O'Connor, 1228 Noble Ave., Bridgeport, Conn.

CHICAGO

Meets second Saturday of each month, at 8 p. m., Atlantic Hotel, 316 S. Clark St. Secretary, Robt. Meyers, 2432 Wilson Ave., Chicago, Ill.

CINCINNATI

Meets every Thursday, 7:30 p. m., at Vocational Training School, Spring and Liberty St. Secretary, W. J. Husing, 729 McMakin Ave., Cincinnati, Ohio.

CLEVELAND

Meets first Saturday of each month at Hotel Winton. Secretary, H. S. Kneeland, 3924 Clybourne Ave., Cleveland, Ohio.

HARTFORD-CONN. VALLEY

Meets in Springfield on alternate months. The Hartford meetings are held at the Hartford Engineers' Club, 12 Haynes St., and the Springfield meetings are held at the Springfield Chamber of Commerce, Broadway and Worthington St., Springfield. Tennant Elwin, Secretary, 117 Hobart St., Meriden, Conn.

DAYTON

Meets first Saturday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Albert Bates, Box 34, Vandalia, Ohio.

DETROIT

Meets the first and third Friday of each month at the Detroit Testing Laboratory, 554 Bagley Ave., Detroit. Secretary, Geo. Kutxen, 1087 W. State Fair Ave., Detroit, Mich.

GRAND RAPIDS

Meets on the second Wednesday of each month at the Vocational High School, 129 Bostwick Ave., N. E. Secretary, John Raven, 1139 Emerald Ave., Grand Rapids, Mich.

INDIANAPOLIS

Meets the second Saturday of each month at Hotel Denison. Secretary, Louis Mertz, 1725 Union St., Indianapolis, Ind.

MILWAUKEE

Meets second and fourth Thursdays of each month at Lipps Hall, 321 3d St. Secretary, Roy Hunt, 1314 Atkinson Ave., Milwaukee, Wis.

MONTREAL

Meets every Friday at 84 Craig St. West. Secretary, John H. Feelay, 411 Aylmer St., Quebec, Canada.

NEWARK

Meets first and third Fridays of each month at Hotel St. Francis, 22-24 E. Park St., Newark, N. J., at 8 p. m. Secretary, Royal F. Clerk, 55 Seymore Ave., Newark, N. J.

NEW YORK

Meets every second and fourth Fridays of each month in the World Building, Park Row, New York City, N. Y. Secretary, J. E. Sterling, 468 Grand Ave., Long Island City, N. Y.

PHILADELPHIA

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, P. Uhl, 2432 North 29th St., Philadelphia, Pa.

PITTSBURGH

Meets first Saturday of each month at 8 p. m., at United States Bureau of Mines Bldg., Forbes St. Secretary, S. E. Hedden, 227 Fifth St., Aspinwall, Pa.

PROVIDENCE-ATTLEBORO

Meets first and third Thursday of each month at 184 Washington St., Room 308, Providence, R. I. Secretary, Robert Crook, 185 County St., Attleboro, Mass.

READING

Meets on the second Tuesday of each month. Secretary, William M. Fisher, 654 Gordon St., Reading Pa.

ROCHESTER

Meets every second and fourth Saturday of each month at the Powers Hotel. C. A. Reama, Secretary, 512 Lyell Ave., Rochester, N. Y.

ST. LOUIS

Meets first Tuesday of each month at Barr Branch Library, corner Jefferson and Lafayete Sts. Secretary, F. P. Menniges, 3205 A Arsenal St., St. Louis.

TOLEDA

Meets first Thursday of each month at Toledo University Science Building, Electro-Platers' Room, corner Cherry and Page Sts. Secretary, W. W. Welker, 411 3d St., Toledo, Ohio.

TORONTO

Meets fourth Monday of each month at Canadian Foresters' Hall, 22 College St., Room No. 2. Walter L. Barrows, 628 Dover Court Road, Toronto, Ontario, Canada.

WATERBURY

Meets every second and fourth Friday of each month. Secretary, Wm. F. Guilfoile, 14 Oakland Ave., Waterbury, Conn.